MAR 21 1920

Technical Paper 256

PRINCETON N. J.

DEPARTMENT OF THE INTERIOR
FRANKLIN K. LANE, SECRETARY

U.S. BUREAU OF MINES
VAN. H. MANNING, DIRECTOR

ACCIDENTS AT METALLURGICAL WORKS IN THE UNITED STATES

DURING THE CALENDAR YEAR 1918

COMPILED BY

ALBERT H. FAY

PRINCETON UNIVERSITY
DEPARTMENT OF GEOLOGY
LIBRARY

WASHINGTON
GOVERNMENT PRINTING OFFICE
1920

The Bureau of Mines, in carrying out one of the provisions of its organic act—to disseminate information concerning investigations made—prints a limited free edition of each of its publications.

When this edition is exhausted, copies may be obtained at cost price only through the Superintendent of Documents, Government Printing Office, Washington, D. C.

The Superintendent of Documents *is not an official of the Bureau of Mines.* His is an entirely separate office and he should be addressed:

SUPERINTENDENT OF DOCUMENTS,
Government Printing Office,
Washington, D. C.

The general law under which publications are distributed prohibits the giving of more than one copy of a publication to one person. The price of this publication is 5 cents.

First edition. January, 1920.

Original from PRINCETON UNIVERSITY

CONTENTS.

Page.
Introduction.. 5
Acknowledgments... 6
Causes of accidents... 6
Classification of injuries for 1916 and 1917.......................... 7
Accidents at ore-dressing plants...................................... 7
Accidents at smelters... 8
Accidents at copper metallurgical plants.............................. 8
Accidents at auxiliary works.. 8
Statistical tables... 8
Publications on accident statistics................................... 21

ACCIDENTS AT METALLURGICAL WORKS IN THE UNITED STATES DURING THE CALENDAR YEAR 1918.

Compiled by ALBERT H. FAY.

INTRODUCTION.

This paper, the fifth report of the Bureau of Mines, on accidents at metallurgical works, shows both fatal and nonfatal accidents at smelters and at ore-dressing plants. The figures for smelting plants include copper, lead, zinc, and quicksilver smelters, as well as refineries. Iron blast-furnaces are not included in the figures given herein. The ore-dressing plants represent concentrating plants for copper, lead, and zinc ores, stamp mills, cyanide plants, iron-ore washers, flotation mills, sampling works, etc. The total number of men reported employed in the metallurgical works, both smelters and ore-dressing plants, was 61,708, as compared with 68,487 in 1917, 66,194 in 1916, 49,891 in 1915, and 43,007 in 1914.

The number of fatalities reported at metallurgical plants was 94, 35 at ore-dressing plants, 42 at smelters, and 17 at auxiliary works, including shops, yards, etc. The number of nonfatal injuries reported at ore-dressing plants was 3,142, at smelters 6,743, and at auxiliary works 2,808.

The fatality and injury rates based on 300-day workers for 1918, compared with previous years, are given in Table 1.

TABLE 1.—*Summary of labor and accidents at metallurgical plants.*

	Men employed.		Days of labor performed.	Average days active.	Total number killed.	Number killed per 1,000 300-day workers.	Total number injured.	Number injured per 1,000 300-day workers.
	Actual number.	300-day workers.						
Ore-dressing plants:								
1913	14,985	16,154	4,846,338	323	16	**0.99**	1,977	**122.38**
1914	15,128	15,225	4,567,529	302	23	**1.51**	1,434	**94.19**
1915	18,564	19,107	5,732,184	309	30	**1.57**	2,095	**109.65**
1916 [a]	22,365	23,470	7,041,083	315	33	**1.41**	3,184	**135.66**
1917 [a]	24,111	24,372	7,311,499	303	47	**1.93**	2,952	**121.12**
1918 [a]	21,809	22,517	6,754,962	310	35	**1.55**	3,142	**139.54**
Smelting plants: [b]								
1913	20,564	24,309	7,292,766	355	47	**1.93**	4,247	**174.71**
1914	27,879	32,336	9,700,769	348	33	**1.02**	5,673	**175.44**
1915	31,327	36,262	10,878,486	347	38	**1.05**	5,718	**157.69**
1916 [a]	43,829	49,363	14,809,046	338	36	**.73**	9,656	**195.61**
1917 [a]	44,376	50,659	15,197,643	342	53	**1.05**	7,745	**152.88**
1918 [a]	39,899	45,439	13,631,601	342	42	**.92**	6,743	**148.40**

[a] Not including auxiliary works, as shops, yards, etc.

[b] Exclusive of the iron and steel industry.

ACKNOWLEDGMENTS.

The data presented in this paper were voluntarily supplied by the officials and managers of the metallurgical companies at the request of the Bureau of Mines, there being no law compelling the companies to render reports. Grateful acknowledgment is made of the hearty cooperation of the many officials who have answered the inquiries, and suggestions are invited as to manner in which the annual report of accidents at metallurgical plants may be improved so as to best serve the industry. Data for California and Colorado, respectively, were furnished by the Industrial Accident Commission and the State commissioner of mines. Statistics for South Dakota were furnished by Otto Ellerman, State mine inspector, and for Nevada by the Industrial Accident Commission. For assistance in the compilation of the various tables the author is indebted to W. W. Adams and Miss Mary Bringhurst.

CAUSES OF ACCIDENTS.

The percentage of accidents due to any one cause is given in Table 7. In the ore-dressing plants machinery was responsible for 40 per cent of all fatalities and 18.17 per cent of all injuries. Similar figures for smelting plants are much smaller for the reason that more machinery is used in ore-dressing plants than at smelters and the men are usually in closer contact with the machinery, as, for example, at jigs, tables, stamps, rolls, and crushers. There are many revolving shafts, a large number of which have projecting keys, moving belts, wheels, and cams within the reach of the operator. The machinery at smelting plants is usually confined to the power house, where the blowers, engines, and dynamos are placed, and to overhead cranes, almost all of which are entirely out of the reach of the regular smelter employees.

A percentage of 17.14 of the fatalities at ore-dressing plants were due to falls of persons, whereas at the smelters the fatalities due to falls of persons represented 9.52 per cent of the total. Fatalities due to electricity represented 7.14 per cent at smelters and 8.57 per cent at ore-dressing plants.

Haulage systems caused 30.96 per cent of the fatalities at smelting plants and 14.29 per cent at ore-dressing plants. Of the nonfatal injuries at ore-dressing plants 5.58 per cent were due to haulage, whereas at smelters 9.58 per cent were due to that cause.

At smelting plants burns from hot metal, slag, etc., claimed 9.52 per cent of the fatalities and 19.13 per cent of the nonfatal injuries.

The tables call attention to the principal causes of accidents at these works and should serve as guides for the safety engineer to show where it will be possible for him to work most efficiently and to accomplish the best results.

Although the figures are representative of the metallurgical industry, they are not absolutely complete. They do, however, cover more than 90 per cent of the industry. The reports received from the operating companies are rendered voluntarily at the request of the bureau, but there are always a few companies that do not reply. Operators of metallurgical plants should be interested enough in accident prevention to contribute whatever aid they can toward reducing accidents in their plants by rendering as complete a report as possible at the close of the year. Hence it is hoped that for the year 1920 those few companies who did not report to the bureau for 1919 will reconsider this matter and furnish a complete report.

CLASSIFICATION OF INJURIES FOR 1917 AND 1918.

Many of the States now have compensation laws, and in order to conform with their classifications the bureau's classification of serious and slight injuries is on a 14-day (2 weeks) basis.

The classification of injuries at mills, smelters, and auxiliary works includes three groups, as follows:

	1918		1917	
1. Fatal		94		116
2. Serious (time lost, more than 14 days):				
(*a*) Permanent disability—				
Total	7		5	
Partial	247		202	
(*b*) Others	3,028		3,302	
3. Slight (time lost, 1 to 14 days, inclusive)	9,411		10,069	
		12,693		13,578
Total		12,787		13,694

[a] Permanent total disability: Loss of both legs or arms, one leg and one arm, total loss of eyesight, paralysis, or other condition permanently incapacitating workman from doing any work of a gainful occupation.

[b] Permanent partial disability: Loss of one foot, leg, hand, eye, one or more fingers, one or more toes, any dislocation where ligaments are severed, or any other injury known in surgery to be permanent partial disability.

ACCIDENTS AT ORE-DRESSING PLANTS.

The number killed in the ore-dressing plants in 1918 was 35, or 1.55 per 1,000 300-day workers employed, as compared with 47 in 1917, when the fatality rate was 1.93. The total number of injuries in 1918 was 3,142, as compared with 2,952 in 1917.

Table 2 shows the number of employees by States, the number of days' work performed, and also the number killed and injured.

Table 3 shows the fatalities by causes and States, and Table 4 the nonfatal injuries, classified by causes and States, during the calendar year 1918.

Table 5 is a summary of the accidents by causes and by States for the the years 1913 to 1918, inclusive.

ACCIDENTS AT SMELTERS.

In 1918 the number of men killed at smelting plants was 42, or 0.92 per 1,000 300-day workers, as compared with 1.05 per 1,000 in 1917. There were reported 6,743 injuries, or 148.40 per 1,000. Table 6 represents a summary of accidents at smelting plants, by causes and by States, showing the number killed and injured during the calendar years 1913 to 1918, inclusive.

Table 2 shows the number of men employed and the number of days worked at smelters by States for the year 1918. It also shows the total number of killed and injured for each State. Tables 3 and 4 show fatalities and injuries by causes and States for 1918.

ACCIDENTS AT COPPER METALLURGICAL PLANTS.

As the mills and smelters treating copper ores represent such an important part of the metallurgical industry of the United States, as well as a branch that is readily segregated, Tables 11 and 12, following, have been compiled from the reports of copper companies whose records appear reasonably complete, and at whose plants efforts are being exerted to maintain safety organizations. These figures represent 44 ore-dressing plants and 25 smelters in various parts of the country, employing 8,222 men at mills and 12,363 at smelters in 1918. Similar figures for a few selected companies were published by the bureau for years 1915, 1916 and 1917.

ACCIDENTS AT AUXILIARY WORKS.

Auxiliary works are intended to include machine shops, carpenter shops, yards, and general construction, all of which, though forming part of the metallurgical plants, should not be included in the actual operating departments. The returns for 1918 show 18,044 men employed, with 17 fatalities and 2,808 injuries. Reduced to the 300-day basis, this represents 20,111 300-day workers, with a fatality rate of 0.85 and a nonfatal-injury rate of 139.63 per 1,000. A large percentage of nonfatal injuries was due to hand tools, falling objects, and falls of persons.

STATISTICAL TABLES.

The tables showing the classification and the number of accidents at metallurgical works in the United States during the calendar year 1918 follow:

TABLE 2.—*Number of men employed, number of days worked, and number of men killed and injured at* ***metallurgical plants*** *in the United States, during the year ended Dec. 31, 1918.*

State.	Ore-dressing plants.					Smelting plants.					Auxiliary works.					Wid-ows.	Or-phans.
	Men em-ployed.	Days of labor per-formed.	Aver-age days active.	Killed.	In-jured.	Men em-ployed.	Days of labor per-formed.	Aver-age days active.	Killed.	In-jured.	Men em-ployed.	Days of labor per-formed.	Aver-age days active.	Killed.	In-jured.		
Alabama	315	57,429	182		25						86	18,388	214		1		
Alaska [a]	336	111,896	333		54						185	65,773	356	1	22	1	1
Arizona	3,319	1,119,017	337	6	653	4,477	1,627,441	364	9	1,412	2,380	831,128	349	5	583	9	9
Arkansas	74	17,090	231	1	6	465	162,975	350	2	53						3	3
California [b]	1,229	442,391	360	3	105	639	229,886	360		289							
Colorado [c]	1,885	565,648	300	2	170	2,671	801,270	300	5	269						4	5
Georgia	(d)										(d)						
Idaho	452	135,221	299		62	(d)					287	101,163	352		25		
Illinois	151	45,840	304		26	3,711	1,341,285	361	3	636	1,449	494,110	341		268	2	2
Kansas	147	31,005	211		31	848	169,679	200	2	125	(d)						
Maryland						2,628	854,689	325	1	131	(d)						
Michigan	1,948	596,086	306	2	88	994	306,790	309		104	(d)						
Minnesota	561	94,522	168		18												
Missouri	1,074	294,256	274	1	249	1,226	334,238	273		482	690	156,078	226		155	1	3
Montana	2,360	747,166	317	4	168	2,452	765,125	312	2	248	2,342	735,328	314	5	186		
Nevada [e]	1,450	521,580	360	6	142	1,297	467,130	360	2	117						6	8
New Jersey	671	203,831	304		60	4,133	1,503,858	364	4	682	2,203	785,038	356	1	225	3	7
New Mexico	773	252,373	326	1	229	(d)					941	334,915	356	1	102		
New York	435	107,088	246	2	56	(d)					500	144,030	288		397		
North Carolina	46	13,436	292		13						8	2,560	320				
Oklahoma	471	115,516	245	1	212	3,064	994,487	325	4	479	520	178,721	344		109	3	1
Oregon	67	20,854	311	1	2	(d)					10	2,935	294		1	1	
Pennsylvania	56	12,771	228		1	3,803	1,382,795	364	2	396	1,437	520,795	362	1	103	3	10
South Dakota [f]	304	96,189	316		32						236	64,508	273	1	26		
Tennessee	266	66,536	250	1	17	(d)					874	298,609	342	1	177		
Texas	72	18,375	255		2	1,116	405,521	363	1	178	565	201,230	356		49		
Utah	1,942	691,255	356	2	525	3,173	1,158,145	365	4	383	1,885	681,762	362		169	4	
Vermont	193	57,419	298		22						(d)						
Virginia	550	155,436	283	1	30	(d)					166	39,693	239		9		
Washington	147	37,775	257		26	(d)					408	133,530	327		45		
West Virginia						712	253,608	356		107	394	141,626	359		91		
Wisconsin	195	58,667	301	1	55	(d)					(d)						
Other States	320	68,294	213		63	2,490	872,679	350	1	652	478	101,264	212	1	65	4	8
Total, 1918	**21,809**	**6,754,962**	**310**	**35**	**3,142**	**39,899**	**13,631,601**	**342**	**42**	**6,743**	**18,044**	**6,033,184**	**334**	**17**	**2,808**	**44**	**57**
Total, 1917	24,111	7,311,499	303	47	2,952	44,376	15,197,643	342	53	7,745	15,555	5,104,146	328	16	2,881	52	102

[a] Stamp mills, other than at lode mines, not included.
[b] Figures relating to California, in this and all other tables, were supplied by the Industrial Accident Commission of the State of California, San Francisco, Calif.
[c] Figures relating to Colorado, in this and all other tables, were supplied by Horace F. Lunt, commissioner of mines, Denver, Colo.
[d] Included in "Other States."
[e] Figures relating to Nevada, in this and all other tables, were supplied by the Industrial Accident Commission, Carson City, Nev.
[f] Figures relating to South Dakota, in this and all other tables, were supplied by Otto Ellerman, State mine inspector, Lead, S. Dak.

Original from PRINCETON UNIVERSITY

TABLE 3.—***Metallurgical plants:*** *Fatalities, by causes and*

State.	Ore-dressing plants.[a]															
	Haulage system (cars, motors, etc.).	Railway cars and locomotives.	Crushers, rolls, or stamps.	Tables, jigs, etc.	Other machinery.	Falls of persons.	Suffocation in ore bins.	Falling objects (rocks, timbers, etc.).	Cyanide or other poisoning.	Scalding (steam or water).	Electricity.	Hand tools, axes, bars, etc.	Nails, splinters, etc.	Flying pieces of rock from sledging or crushing.	Other causes.	**Total.**
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Alabama																
Alaska																
Arizona					3	1					1				1	6
Arkansas	1															1
California					1	1			1							3
Colorado					1						1					2
Georgia																
Idaho																
Illinois																
Kansas																
Maryland																
Michigan	1				1											2
Minnesota																
Missouri					1											1
Montana	1														3	4
Nevada	1				2	3										6
New Jersey																
New Mexico					1											1
New York							1				1					2
North Carolina																
Oklahoma						1										1
Oregon					1											1
Pennsylvania																
South Dakota																
Tennessee							1									1
Texas																
Utah					2											2
Vermont																
Virginia		1														1
Washington																
West Virginia																
Wisconsin					1											1
Other States																
Total 1918	**4**	**1**			**14**	**6**	**2**		**1**		**3**				**4**	**35**
Total 1917	7	4	3	2	9	9	3	4		1	4				1	**47**

[a] Stamp mills, sampling works, slime plants, lixiviation, leaching, cyanide, and flotation mills.
[b] Blast, reverberatory, and roasting furnaces; convertors, casting department, and refineries.

States*, *during the year ended Dec. 31, 1918.

Smelting plants.[b]																Auxiliary works.[c]											
Haulage system (cars, motors, etc.).	Railway cars and locomotives.	Cranes.	Other machinery.	Falls of persons.	Suffocation in ore bins.	Flying or falling objects (rocks, timbers, etc.).	Gas (burns or asphyxiation).	Scalding (steam or water).	Electricity.	Hand tools, axes, bars, etc.	Nails, splinters, etc.	Burns from matte, slag, or molten metal (pouring or spilling).	Hot-metal explosions.	Other causes.	Total.	Haulage system (cars, motors, etc.).	Railway cars and locomotives.	Falls of persons.	Falling objects (rocks, timbers, etc.).	Nails, splinters, etc.	Hand tools, axes, bars, etc.	Electricity.	Machinery.	Failure of ladder, scaffold, or other support.	Handling hot materials.	Other causes.	Total.
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30		31	32	33	34	35	36	37	38	39	40	41	
																						1					1
2			2	1								3	1		9				1					2		2	5
			1											1	2												
3			1						1						5												
1	1	1													3												
	1			1											2												
		1													1												
			1						1						2							1	2			2	5
	1		1												2												
1			1	1									1		4		1										1
																										1	1
			4												4												
	1											1			2		1										1
																							1				1
																	1										1
	1														1												
1			1	1					1						4												
			1												1		1										1
8	**5**	**2**	**13**	**4**	..	......	....	..	**3**	...	...	**4**	**2**	**1**	**42**	...	**4**	...	**1**	...	...	**2**	**3**	**2**	...	**5**	**17**
7	4	3	9	8	1	2	...	2	9	...	...	2	2	4	**53**	1	2	8	2	1	...	...	...	1	...	1	**16**

[c] Yards, shops, construction, etc.

TABLE 4.—***Metallurgical plants:*** *Injuries, by causes and*

State.	Ore-dressing plants.[a]															
	Haulage system (cars, motors, etc.). 1	Railway cars and locomotives. 2	Crushers, rolls, or stamps. 3	Tables, jigs, etc. 4	Other machinery. 5	Falls of persons. 6	Suffocation in ore bins. 7	Falling objects (rocks, timbers, etc.). 8	Cyanide or other poisoning. 9	Scalding (steam or water). 10	Electricity. 11	Hand tools, axes, bars, etc. 12	Nails, splinters, etc. 13	Flying pieces of rock from sledging or crushing. 14	Other causes. 15	**Total.**
Alabama	....	....	1	1	13	3	....	2	....	....	....	1	....	4	....	**25**
Alaska	4	1	8	2	4	6	....	3	....	....	2	4	3	1	16	**54**
Arizona	19	12	9	14	74	75	6	67	26	4	15	70	35	26	201	**653**
Arkansas	....	....	....	....	3	....	....	2	....	....	....	....	....	....	1	**6**
California	1	....	1	....	5	11	....	21	9	....	2	8	12	1	34	**105**
Colorado	10	1	4	2	25	33	1	22	1	....	4	20	11	12	24	**170**
Georgia	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Idaho	2	2	3	1	9	12	....	6	....	....	....	4	2	....	21	**62**
Illinois	....	....	3	1	4	1	....	4	....	....	....	3	2	1	7	**26**
Kansas	....	....	1	1	2	4	....	5	1	....	....	4	2	7	4	**31**
Maryland	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Michigan	5	1	1	4	10	18	....	4	....	1	2	18	1	4	19	**88**
Minnesota	1	2	....	....	....	4	....	5	....	....	....	1	....	1	4	**18**
Missouri	3	1	15	6	29	18	....	17	....	2	3	21	12	24	98	**249**
Montana	6	4	5	8	35	32	2	24	....	....	3	9	8	3	29	**168**
Nevada	19	2	11	8	21	32	....	12	2	....	2	6	....	2	25	**142**
New Jersey	3	1	2	2	15	5	1	3	....	1	....	4	1	3	19	**60**
New Mexico	6	9	10	15	24	39	....	32	1	1	5	32	18	4	33	**229**
New York	1	3	5	....	13	4	....	9	....	....	3	....	3	....	15	**56**
North Carolina	....	6	....	....	3	4	....	....	....	....	....	....	....	....	....	**13**
Oklahoma	4	1	12	11	15	14	....	33	....	1	....	13	2	78	28	**212**
Oregon	1	....	....	....	....	....	....	....	....	....	1	....	....	....	....	**2**
Pennsylvania	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	**1**
South Dakota	2	....	6	....	1	1	....	3	....	....	....	....	1	3	15	**32**
Tennessee	2	....	....	....	9	1	....	....	....	....	....	....	1	....	4	**17**
Texas	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	**2**
Utah	16	16	3	8	37	78	1	99	5	5	19	61	45	16	116	**525**
Vermont	....	1	2	....	1	4	....	1	....	....	....	3	1	3	6	**22**
Virginia	....	1	....	....	7	5	....	5	....	....	....	6	2	....	4	**30**
Washington	....	2	3	....	....	5	....	6	....	....	....	1	1	....	8	**26**
West Virginia	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Wisconsin	1	....	4	8	2	4	....	4	....	....	....	4	1	5	22	**55**
Other States	1	2	2	....	5	1	....	....	....	....	2	4	1	....	45	**63**
Total 1918	**107**	**68**	**111**	**92**	**368**	**414**	**11**	**389**	**45**	**15**	**63**	**298**	**165**	**198**	**798**	**3,142**
Total 1917	135	29	112	61	282	399	6	371	24	18	40	249	193	302	731	**2,952**

[a] Stamp mills, sampling works, slime plants, lixiviation, leaching, cyanide, and flotation mills.

[b] Blast, reverberatory, and roasting furnaces; convertors, casting department, and refineries.

States, during the year ended Dec. 31, 1918.

Smelting plants.[b]																Auxiliary works.[c]											
Haulage system (cars, motors, etc.).	Railway cars and locomotives.	Cranes.	Other machinery.	Falls of persons.	Suffocation in ore bins.	Flying or falling objects (rocks, timbers, etc.)	Gas (burns or asphyxiation).	Scalding (steam or water).	Electricity.	Hand tools, axes, bars, etc.	Nails, splinters, etc.	Burns from matte, slag, or molten metal (pouring or spilling).	Hot-metal explosions.	Other causes.	Total.	Hauling system (cars, motors, etc.).	Railway cars and locomotives.	Falls of persons.	Falling objects (rocks, timbers, etc.).	Nails, splinters, etc.	Hand tools, axes, bars, etc.	Electricity.	Machinery.	Failure of ladder, scaffold, or other support.	Handling hot materials.	Other causes.	Total.
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30		31	32	33	34	35	36	37	38	39	40	41	
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	1
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	8	...	5	...	...	...	..	1	1	..	7	22
87	4	20	60	95	4	218	4	8	19	175	49	246	50	373	1,412	8	10	57	65	28	43	10	52	17	24	269	583
2	...	...	2	3	..	1	12	..	..	6	...	10	4	13	53	...	...	...	...	...	...	...	...	...	...	...	...
5	2	3	27	26	..	37	2	6	..	20	26	40	10	85	289	...	...	...	...	...	...	...	...	...	...	...	...
75	...	2	12	33	..	58	...	1	1	25	3	33	15	11	269	...	...	...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3	1	6	4	1	3	..	3	1	..	3	25
75	17	8	73	41	1	55	37	3	2	53	9	103	35	124	636	30	7	17	31	14	25	2	22	3	12	105	268
8	1	...	5	9	..	8	...	..	..	16	5	19	2	52	125	...	...	...	...	...	...	...	...	...	...	...	...
2	9	1	14	12	..	51	4	4	..	5	4	9	5	11	131	...	...	...	...	...	...	...	...	...	...	...	...
4	3	...	4	10	..	9	...	..	..	20	1	5	...	48	104	...	...	...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8	...	...	3	22	..	31	8	2	3	62	13	87	70	173	482	1	3	14	20	11	23	..	4	1	1	77	155
22	3	10	19	27	..	56	1	3	1	14	3	36	7	46	248	3	1	34	55	11	13	..	27	..	3	39	186
17	8	1	13	12	..	21	1	1	..	4	1	12	7	19	117	...	...	...	...	...	...	...	...	...	...	...	...
102	27	24	19	57	..	132	7	22	1	27	12	84	13	155	682	18	7	30	73	7	23	2	11	1	16	37	225
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	12	17	16	12	2	5	2	2	32	102
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3	1	1	2	..	2	..	...	388	397
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	...	...	56	24	..	44	5	2	..	13	4	217	14	70	479	12	1	13	18	4	10	..	18	3	8	22	109
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	1
19	6	0	14	10	..	57	44	10	..	12	7	53	6	149	396	...	1	5	16	2	8	..	1	..	...	70	103
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	...	2	1	...	1	..	4	..	1	15	26
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	6	16	57	9	31	3	4	1	2	47	177
39	3	3	10	23	..	48	2	2	3	11	3	26	1	4	178	10	...	...	34	...	5	..	...	..	...	...	49
33	3	2	13	56	..	113	3	1	7	35	9	60	4	44	383	9	11	21	42	9	13	4	17	2	8	33	169
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	1	2	1	...	..	2	..	...	2	9
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	3	4	15	1	8	..	6	..	..	6	45
2	...	1	7	...	..	6	2	1	..	1	5	61	...	21	107	13	2	8	16	3	10	2	7	1	7	22	91
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
29	1	13	26	36	..	105	4	2	4	63	9	189	12	159	652	3	...	4	9	9	11	3	2	..	1	23	65
559	**87**	**97**	**377**	**496**	**5**	**1,050**	**136**	**68**	**41**	**562**	**163**	**1,290**	**255**	**1,557**	**6,743**	**124**	**56**	**252**	**476**	**127**	**241**	**29**	**188**	**33**	**85**	**1,197**	**2,808**
693	113	146	375	564	73	1,107	48	76	37	736	208	1,488	242	1,839	7,745	184	47	319	585	220	345	42	213	54	121	751	2,881

[c] **Yards, shops, construction, etc.**

TABLE 5.—***Ore-dressing plants:*** *Fatalities and injuries, by causes and States, 1913 to 1918.*

	Killed.						Injured.					
	1913	1914	1915	1916	1917	1918	1913	1914	1915	1916	1917	1918
Accidents by causes:												
1. Haulage system (cars, motors, etc.)	1	.....	3	3	7	4	98	79	106	146	135	107
2. Railway cars and locomotives	1	3	2	4	4	1	34	38	17	42	29	68
3. Crushers, rolls, or stamps	.....	2	5	.....	3	.....	64	64	129	168	112	111
4. Tables, jigs, etc	.....	.....	.....	.....	2	.....	65	46	59	82	61	92
5. Other machinery	2	6	7	11	9	14	219	170	299	336	282	368
6. Falls of persons	3	3	6	2	9	6	238	205	249	373	399	414
7. Suffocation in ore bins	1	2	3	3	3	2	.....	2	3	4	6	11
8. Falling objects (rocks, timbers, etc.)	3	3	.....	1	4	.....	367	222	192	363	371	389
9. Cyanide or other poisoning	1	.....	.....	.....	.....	1	8	9	23	13	24	45
10. Scalding (steam or water)	.....	.....	.....	2	1	.....	24	9	12	35	18	15
11. Electricity	1	2	3	2	4	3	21	30	38	53	40	63
12. Hand tools, axes, bars, etc	.....	.....	.....	1	.....	.....	199	133	235	360	249	298
13. Nails, splinters, etc	.....	.....	.....	.....	.....	.....	74	78	131	171	193	165
14. Flying pieces of rock from sledging or crushing	.....	.....	.....	.....	.....	.....	132	50	76	109	302	198
15. Other causes	3	2	1	4	1	4	434	299	526	929	731	798
Total	**16**	**23**	**30**	**33**	**47**	**35**	**1,977**	**1,434**	**2,095**	**3,184**	**2,952**	**3,142**
Accidents by States:												
Alabama	.....	.....	1	.....	1	.....	16	1	6	9.	7	25
Alaska	.....	1	.....	.....	3	.....	.....	30	73	127	141	54
Arizona	4	5	1	3	6	6	335	287	350	524	578	653
Arkansas	.....	.....	.....	.....	.....	1	.....	.....	2	20	11	6
California	.....	1	2	.....	.....	3	36	111	91	118	30	105
Colorado	5	2	7	4	7	2	127	103	153	176	214	170
Georgia	.....	.....	.....	.....	.....	.....	.....	.....	3	9	1	.....
Idaho	1	1	1	.....	.....	.....	30	19	55	75	62	62
Illinois	.....	.....	.....	.....	.....	.....	34	3	3	4	9	26
Kansas	.....	.....	.....	.....	.....	.....	.....	.....	2	7	15	31
Maryland	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	.....
Michigan	.....	1	.....	2	2	2	25	51	112	137	88	88
Minnesota	.....	.....	.....	.....	.....	.....	.....	.....	22	48	40	18
Missouri	1	2	2	1	2	1	209	180	155	186	175	249
Montana	1	4	5	3	6	4	189	121	292	168	148	168
Nevada	.....	2	4	1	4	6	83	83	147	133	117	142
New Jersey	.....	.....	1	3	2	.....	29	27	26	45	57	60
New Mexico	1	.....	2	4	1	1	111	95	131	310	183	229
New York	.....	.....	1	4	1	2	.....	12	38	73	77	56
North Carolina	.....	.....	.....	.....	.....	.....	.....	.....	4	3	14	13
Oklahoma	.....	.....	.....	.....	2	1	11	35	3	15	208	212
Oregon	.....	.....	.....	.....	.....	1	3	5	11	2	6	2
Pennsylvania	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	1	1
South Dakota	.....	.....	.....	.....	.....	.....	34	10	33	51	23	32
Tennessee	.....	.....	.....	1	1	1	13	1	27	48	40	17
Texas	.....	.....	.....	.....	.....	.....	.....	7	.....	7	6	2
Utah	2	4	2	5	5	2	531	211	263	711	496	525
Vermont	.....	.....	.....	.....	.....	.....	.....	.....	3	8	13	22
Virginia	.....	.....	1	1	.....	1	20	5	35	43	16	30
Washington	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	8	26
West Virginia	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Wisconsin	.....	.....	.....	.....	3	1	68	16	51	90	150	55
Other States	1	.....	.....	1	1	.....	73	21	4	35	18	63
Total	**16**	**23**	**30**	**33**	**47**	**35**	**1,977**	**1,434**	**2,095**	**3,184**	**2,952**	**3,142**

TABLE 6.—***Smelting plants:*** *Fatalities and injuries, by causes and States, 1913 to 1918.*

	Killed.						Injured.					
	1913	**1914**	**1915**	**1916**	**1917**	**1918**	1913	1914	1915	1916	1917	1918
Accidents by causes:												
16. **Haulage system (cars, motors, etc.)**	5	3	10	4	7	8	386	495	529	814	693	559
17. **Railway cars and locomotives**	5	7	2	2	4	5	75	111	61	117	113	87
18. **Cranes**	4	.....	2	5	3	2	68	55	58	130	146	97
19. **Other machinery**	8	3	5	3	9	13	253	250	290	385	375	377
20. **Falls of persons**	10	6	3	9	8	4	364	620	499	757	564	496
21. **Suffocation in ore bins**	1	2	1	1	1	.....	13	1	8	1	73	5
22. **Flying or falling objects (rocks, timbers, etc.)**	3	1	1	4	2	.....	603	1,052	914	1,438	1,107	1,050
23. **Gas (burns or asphyxiation)**	.....	.....	3	1	.....	.....	18	59	68	112	48	136
24. **Scalding (steam or water)**	.....	1	2	1	2	.....	45	62	46	132	76	68
25. **Electricity**	2	2	4	1	9	3	57	49	46	36	37	41
26. **Hand tools, axes, bars, etc.**	.....	.....	.....	.....	.....	.....	423	586	633	875	736	562
27. **Nails, splinters, etc**	.....	.....	.....	.....	.....	.....	79	96	146	252	208	163
28. **Burns from matte, slag, or molten metal (pouring or spilling)**	4	2	3	1	2	4	777	959	894	2,163	1,488	1,290
29. **Hot-metal explosions**	2	.....	1	3	2	2	148	162	160	217	242	255
30. **Other causes**	3	6	1	1	4	1	938	1,116	1,366	2,227	1,839	1,557
Total	**47**	**33**	**38**	**36**	**53**	**42**	**4,247**	**5,673**	**5,718**	**9,656**	**7,745**	**6,743**
Accidents by States:												
Arizona	15	3	7	1	10	9	805	553	574	1,112	1,184	1,412
Arkansas	.....	.....	.....	.....	.....	2	.....	.....	.....	154	83	53
California	2	1	.....	1	5	.....	144	163	163	224	188	289
Colorado	1	2	6	1	1	5	295	636	404	508	331	269
Illinois	2	3	2	2	3	3	271	697	782	1,356	749	636
Kansas	.....	.....	1	3	1	2	63	89	408	695	283	125
Maryland	.....	.....	.....	1	2	1	.....	.....	.....	605	359	131
Michigan	.....	.....	.....	1	.....	.....	.....	.....	.....	251	164	104
Missouri	.....	.....	3	2	2	.....	353	257	304	317	437	482
Montana	4	6	6	3	.....	2	390	538	457	333	238	248
Nevada	5	1	.....	.....	3	2	128	33	58	90	132	117
New Jersey	2	3	4	6	5	4	200	622	630	646	677	682
New Mexico	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	10	.....
New York	1	1	.....	1	.....	.....	15	49	.....	361	.....	.....
Oklahoma	3	1	1	1	4	4	121	97	262	817	895	479
Oregon	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Pennsylvania	.....	1	2	3	3	2	251	205	339	610	608	396
South Dakota	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	.....
Tennessee	.....	1	1	1	.....	.....	372	326	249	241	.....	.....
Texas	.....	.....	.....	.....	.....	1	.....	.....	.....	179	164	178
Utah	10	5	3	8	9	4	554	605	437	622	556	383
Vermont	.....	.....	.....	.....	.....	.....	.....	.....	.....	2	.....	.....
Virginia	.....	.....	.....	.....	.....	.....	.....	.....	.....	39	.....	.....
Washington	.....	.....	.....	1	.....	.....	.....	.....	.....	135	.....	.....
West Virginia	1	.....	1	.....	1	.....	86	61	106	148	182	107
Wisconsin	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	36	.....
Other States	1	5	1	.....	4	1	199	742	545	209	469	652
Total	**47**	**33**	**38**	**36**	**53**	**42**	**4,247**	**5,673**	**5,718**	**9,656**	**7,745**	**6,743**

TABLE 7.—***Metallurgical plants:*** *Percentage of fatalities and injuries, by* ***causes,*** *during the year ended Dec. 31, 1918.*

Cause of accident.	Killed.			Injured.		
	Number killed.	Per cent of group total.	Per cent of grand total.	Number injured.	Per cent of group total.	Per cent of grand total.
Ore-dressing plants:						
1. Haulage system (cars, motors, etc.).,	4	11.43	4.26	107	3.41	0.84
2. Railway cars and locomotives	1	2.86	1.06	68	2.17	.54
3. Crushers, rolls, or stamps	......	......	......	111	3.53	.87
4. Tables, jigs, etc	......	......	......	92	2.93	.72
5. Other machinery	14	40.00	14.89	368	11.71	2.90
6. Falls of persons	6	17.14	6.38	414	13.18	3.26
7. Suffocation in ore bins	2	5.71	2.13	11	.36	.09
8. Falling objects (rocks, timbers, etc.)	......	......	......	389	12.38	3.06
9. Cyanide or other poisoning.,	1	2.86	1.06	45	1.43	.35
10. Scalding (steam or water)	......	......	......	15	.45	.12
11. Electricity	3	8.57	3.19	63	2.01	.50
12. Hand tools, axes, bars, etc	......	......	......	298	9.49	2.35
13. Nails, splinters, etc	......	......	......	165	5.25	1.30
14. Flying pieces of rock from sledging or crushing	......	......	......	198	6.30	1.56
15. Other causes	4	11.43	4.26	798	25.40	6.29
Total	**35**	**100.00**	**37.23**	**3,142**	**100.00**	**24.75**
Smelting plants:						
16. Haulage system (cars, motors, etc.)	8	19.05	8.51	559	8.29	4.40
17. Railway cars and locomotives	5	11.91	5.32	87	1.29	.69
18. Cranes	2	4.76	2.13	97	1.44	.76
19. Other machinery	13	30.96	13.83	377	5.59	2.97
20. Falls of persons	4	9.52	4.26	496	7.36	3.90
21. Suffocation in ore bins	......	......	......	5	.07	.04
22. Flying or falling objects (rocks, timbers, etc.)	......	......	......	1,050	15.57	8.27
23. Gas (burns or asphyxiation)	......	......	......	136	2.02	1.07
24. Scalding (steam or water)	......	......	......	68	1.01	.54
25. Electricity	3	7.14	3.19	41	.61	.32
26. Hand tools, axes, bars, etc	......	......	......	562	8.33	4.42
27. Nails, splinters, etc	......	......	......	163	2.42	1.29
28. Burns from matte, slag, or molten metal (pouring or spilling)	4	9.52	4.26	1,290	19.13	10.16
29. Hot-metal explosions	2	4.76	2.13	255	3.78	2.01
30. Other causes	1	2.38	1.06	1,557	23.09	12.28
Total	**42**	**100.00**	**44.68**	**6,743**	**100.00**	**53.12**
Auxiliary works:						
31. Haulage system (cars, motors, etc.)	......	......	......	124	4.42	.98
32. Railway cars and locomotives	4	23.53	4.26	56	1.98	.44
33. Falls of persons	......	......	......	252	8.98	1.99
34. Falling objects (rocks, timbers, etc.)	1	5.88	1.06	476	16.95	3.75
35. Nails, splinters, etc	......	......	......	127	4.52	1.00
36. Hand tools, axes, bars, etc	......	......	......	241	8.58	1.90
37. Electricity	2	11.76	2.13	29	1.03	.23
38. Machinery	3	17.65	3.19	188	6.70	1.48
39. Failure of ladder, scaffold, or other support	2	11.76	2.13	33	1.18	.26
40. Handling hot materials	......	......	......	85	3.03	.67
41. Other causes	5	29.41	5.32	1,197	42.63	9.43
Total	**17**	**100.00**	**18.09**	**2,808**	**100.00**	**22.13**
Grand total	**94**	....	**100.00**	**12,693**	....	**100.00**

TABLE 8.—***Metallurgical plants:*** *Men employed and the equivalent in 300-day workers, by States, 1913 to 1918.*

State.	Actual number employed.												Equivalent in 300-day workers (calculated).											
	Ore-dressing plants.						Smelting plants.						Ore-dressing plants.						Smelting plants.					
	1913	1914	1915	1916	1917	**1918**	1913	1914	1915	1916	1917	**1918**	1913	1914	1915	1916	1917	**1918**	1913	1914	1915	1916	1917	**1918**
Alabama	130	100	57	92	193	**315**	......	......	......	......	......	......	104	58	19	55	149	**191**	......	......	......	......	......	......
Alaska	......	225	520	925	467	**336**	......	......	......	......	......	......	......	253	530	1,111	467	**373**	......	......	......	......	......	......
Arizona	1,321	1,314	1,776	2,380	2,630	**3,319**	2,979	2,491	2,813	3,470	4,398	**4,477**	1,529	1,457	1,839	2,637	2,679	**3,730**	3,549	2,919	3,034	4,034	5,068	**5,425**
Arkansas	......	(*a*)	89	173	163	**74**	......	......	......	410	530	**465**	......	......	75	142	128	**57**	......	......	......	251	609	**543**
California	668	581	766	794	755	**1,229**	1,093	917	1,050	1,146	590	**639**	645	512	812	780	906	**1,475**	1,172	1,047	1,239	1,274	708	**766**
Colorado	785	960	1,219	1,382	1,715	**1,885**	2,734	2,810	2,327	3,099	2,864	**2,671**	867	975	1,219	1,382	1,715	**1,885**	3,298	3,356	2,799	3,098	2,864	**2,671**
Georgia	(*a*)	(*a*)	57	68	82	(*a*)	......	......	......	......	......	......	......	......	48	65	83	......	......	......	......	......	......	......
Idaho	372	441	470	611	642	**452**	......	......	......	......	(*a*)	(*a*)	350	388	438	629	597	**451**	......	......	......	......	......	......
Illinois	178	164	(*a*)	58	156	**151**	1,946	3,228	3,467	4,735	3,731	**3,711**	149	121	......	36	143	**153**	2,324	3,892	4,159	5,434	4,398	**4,471**
Kansas	(*a*)	(*a*)	114	80	206	**147**	800	942	2,584	3,611	2,148	**848**	......	......	85	79	107	**103**	896	1,126	2,454	4,083	2,077	**566**
Maryland	......	......	(*a*)	9	26	......	......	......	......	1,300	3,414	**2,628**	......	......	......	5	18	......	......	......	......	1,522	3,726	**2,849**
Michigan	756	1,761	2,354	2,255	2,426	**1,948**	(*a*)	(*a*)	724	1,001	1,197	**994**	507	1,646	2,406	2,346	2,510	**1,987**	......	......	748	1,089	1,238	**1,023**
Minnesota	(*a*)	(*a*)	241	286	337	**561**	......	......	......	......	......	......	......	......	161	239	269	**315**	......	......	......	......	......	......
Missouri	1,657	1,466	1,462	1,375	1,523	**1,074**	1,096	980	1,155	1,532	1,560	**1,226**	1,630	1,339	1,316	1,332	1,307	**981**	1,308	1,177	1,336	1,806	1,898	**1,114**
Montana	2,527	1,709	2,451	2,153	2,051	**2,360**	1,224	2,508	3,344	3,200	2,399	**2,452**	3,011	1,725	2,655	2,152	2,019	**2,490**	1,489	2,642	4,002	3,265	2,507	**2,550**
Nevada	1,444	1,396	1,401	1,556	1,565	**1,450**	840	726	722	870	1,143	**1,297**	1,697	1,525	1,541	1,713	1,621	**1,739**	1,013	843	866	1,018	1,378	**1,557**
New Jersey	383	440	562	715	537	**671**	757	3,567	4,116	4,870	4,313	**4,133**	385	451	607	804	551	**679**	917	4,048	4,958	5,929	5,123	**5,013**
New Mexico	694	741	762	1,346	891	**773**	(*a*)	......	(*a*)	48	152	(*a*)	842	786	878	1,547	969	**841**	......	......	......	55	76	......
New York	......	145	370	567	565	**435**	110	210	......	570	(*a*)	(*a*)	......	104	348	509	522	**357**	118	215	......	514	......	......
North Carolina	(*a*)	(*a*)	94	55	46	**46**	......	......	......	......	......	......	......	......	61	51	38	**45**	......	......	......	......	......	......
Oklahoma	254	404	113	94	452	**471**	1,181	1,210	1,679	5,181	5,063	**3,064**	279	394	88	71	346	**385**	1,437	1,414	2,043	5,487	6,093	**3,315**
Oregon	40	142	69	77	97	**67**	(*a*)	......	(*a*)	22	(*a*)	(*a*)	37	113	56	40	79	**70**	......	......	......	25	......	......
Pennsylvania	(*a*)	......	(*a*)	25	24	**56**	1,527	1,279	2,015	2,583	3,700	**3,803**	......	......	......	26	17	**43**	1,832	1,509	2,205	3,106	4,442	**4,609**
South Dakota	360	358	395	362	250	**304**	(*a*)	......	......	16	......	......	392	431	461	387	292	**321**	......	......	......	8	......	......
Tennessee	218	87	328	460	425	**266**	460	299	(*a*)	200	(*a*)	(*a*)	173	90	264	401	382	**222**	549	351	......	234	......	......
Texas	72	57	......	60	100	**72**	(*a*)	(*a*)	919	963	1,100	**1,116**	63	62	......	58	98	**61**	......	......	1,118	1,172	1,336	**1,352**
Utah	2,329	2,054	1,664	3,017	4,103	**1,942**	1,609	2,779	2,198	2,401	2,658	**3,173**	2,804	2,398	2,005	3,579	4,865	**2,304**	1,958	3,377	2,674	2,928	3,176	**3,861**
Vermont	......	......	131	137	215	**193**	......	......	......	8	......	......	......	......	123	140	194	**191**	......	......	......	2	......	......
Virginia	174	100	488	475	709	**550**	(*a*)	(*a*)	(*a*)	251	(*a*)	(*a*)	193	81	511	453	690	**518**	......	......	......	290	......	......
Washington	28	18	(*a*)	17	63	**147**	(*a*)	(*a*)	865	1,045	(*a*)	(*a*)	3	12	......	14	39	**126**	......	......	1,052	1,171	......	......
West Virginia	......	......	......	......	......	......	919	826	834	932	1,090	**712**	......	......	......	......	......	......	1,099	980	1,014	1,130	1,269	**845**
Wisconsin	197	175	254	421	247	**195**	......	(*a*)	(*a*)	5	113	(*a*)	179	132	268	376	213	**196**	......	......	......	5	124	......
Other States	398	290	357	340	450	**320**	1,289	3,107	515	360	2,213	**2,490**	315	172	293	311	359	**228**	1,350	3,440	561	433	2,549	**2,909**
Total	**14,985**	**15,128**	**18,564**	**22,365**	**24,111**	**21,809**	**20,564**	**27,879**	**31,327**	**43,829**	**44,376**	**39,899**	**16,154**	**15,225**	**19,107**	**23,470**	**24,372**	**22,517**	**24,309**	**32,336**	**36,262**	**49,363**	**50,659**	**45,439**

a Included in "Other States."

TABLE 9.—*Metallurgical plants: Days of labor performed and average number of days plants were operated, by States, 1913 to 1918.*

State.	Days of labor performed.												Average days active.											
	Ore-dressing plants.						Smelting plants.						Ore-dressing plants.						Smelting plants.					
	1913	1914	1915	1916	1917	1918	1913	1914	1915	1916	1917	1918	1913	1914	1915	1916	1917	1918	1913	1914	1915	1916	1917	1918
Alabama	31,250	17,250	5,572	16,488	44,715	57,429							240	173	98	179	232	182						
Alaska		76,046	159,078	333,360	139,960	111,896								338	306	360	300	333						
Arizona	458,681	437,061	551,719	790,821	803,567	1,119,017	1,064,714	875,543	910,120	1,210.377	1,520,283	1,627,441	347	333	311	332	306	337	357	351	324	349	346	364
Arkansas			22,400	42,730	38,343	17,090				75,240	182,575	162,975			252	247	235	231				184	344	350
California	193,403	153,471	243,708	234,004	271,800	442,391	351,610	314,162	371,847	382,190	212,400	229.886	290	264	318	295	360	360	322	343	354	333	360	360
Colorado	260,052	292,491	365,678	414,681	514,500	565,648	989,335	1,006,670	839,587	929,559	859,200	801,270	331	305	300	300	300	300	362	358	361	300	300	300
Georgia			14,540	19,430	24,769										255	286	302							
Idaho	105,023	116,527	131,352	188,673	179,238	135,221							282	264	279	309	279	299						
Illinois	44,794	36,325		10,742	43,008	45,840	697,120	1,167,544	1,247,660	1,630.241	1,319,525	1,341,285	252	221		185	276	304	358	362	360	344	354	361
Kansas			25,584	23,853	32,190	31,005	268,870	337,890	736,108	1,224,975	623,042	169,679			224	298	156	211	336	359	285	339	290	200
Maryland				1,395	5,432					456,500	1,117,802	854,689				155	209					351	327	325
Michigan	152,121	493,875	721,634	703,788	752,874	596,086			224,250	326,669	371,479	306,790	201	280	307	312	310	306			310	326	310	309
Minnesota			48,385	71,663	80,703	94,522									201	251	239	168						
Missouri	489,091	401,615	394,850	399,764	392,225	294,256	392,467	353,126	400,689	541,880	569,400	334,238	295	274	270	291	258	274	358	360	347	354	365	273
Montana	903,414	517,458	796,575	645,679	605,705	747,166	446,645	792,731	1,200,496	979,580	752,157	765,125	358	303	325	300	295	317	365	316	359	306	314	312
Nevada	509,108	457,581	462,322	514,024	486,255	521,580	303,846	253,006	259,972	305,372	413,423	467,130	353	328	330	330	311	360	362	348	360	351	362	360
New Jersey	115,420	135,312	182,230	241,165	165,308	203,831	275,288	1,214,362	1,487,345	1,778,862	1,536,773	1,503,858	301	308	324	337	308	304	364	340	361	365	356	364
New Mexico	252,772	235,843	263,494	464,224	290,846	252,373				16,464	22,680		364	318	346	345	326	326				343	149	
New York		31,151	104,382	152,632	156,601	107,088	35,500	64,500		154,200				215	282	269	277	246	323	307		271		
North Carolina			18,265	15,186	11,285	13,436									194	276	245	292						
Oklahoma	83,795	118,217	26,397	21,283	103,933	115,516	431,065	424,145	612,835	1,646,034	1,827,884	994,487	330	293	234	226	230	245	365	351	365	318	361	325
Oregon	11,033	33,960	16,879	11,969	23,637	20,854				7,568			276	239	245	155	244	311				344		
Pennsylvania				7,830	5,165	12,771	549,640	452,803	661,376	931,710	1,332,500	1,382,795				313	215	228	360	354	328	361	360	364
South Dakota	117,458	129,410	138,182	115,978	87,475	96,189				2,359			326	361	350	320	350	316				147		
Tennessee	51,822	27,131	79,091	120,370	114,513	66,536	164,700	105,229		70,200			238	312	241	262	269	250	358	352		351		
Texas	18,964	18,465		17,370	29,330	18,375			335,435	351,495	400,962	405,521	263	324		290	293	255			365	365	365	363
Utah	841,164	719,243	601,358	1,073,745	1,459,383	691,255	587,285	1,013,095	802,270	878,426	952,918	1,158,145	361	350	361	356	356	356	365	365	365	365	359	365
Vermont			36,822	42,074	58,308	57,419				400					281	307	271	298				50		
Virginia	57,874	24,330	153,397	136,038	206,921	155,436				86,956			333	243	314	286	292	283				346		
Washington	960	3,520		4,059	11,800	37,775			315,725	351,275			34	196		239	187	257			365	336		
West Virginia							329,605	294,015	304,368	339,024	380,578	253,608							359	356	365	364	349	356
Wisconsin	53,678	39,624	80,296	112,854	64,011	58,667				1,500	37,225		272	226	316	268	259	301				300	329	
Other States	94,461	51,623	87,994	93,211	107,699	68,294	405,076	1,031,948	168,403	129,990	764,837	872,679	237	178	247	274	239	213	314	332	327	361	346	350
Total	4,846,338	4,567,529	5,732,184	7,041,083	7,311,499	6,754,962	7,292,766	9,700,769	10,878,486	14,809,046	15,197,643	13,631,601	323	302	309	315	303	310	355	348	347	338	342	342

Metallurgical plants.

TABLE 10.—*Injuries and number injured per 1,000 300-day workers employed, by causes, 1913 to 1918.*

Cause of accident.	Number injured.						Number injured per 1,000 300-day workers.					
	1913	1914	1915	1916	1917	1918	1913	1914	1915	1916	1917	1918
Ore-dressing plants:												
1. Haulage system (cars, motors, etc.)	98	79	106	146	135	107	6.07	5.19	5.55	6.22	5.54	4.75
2. Railway cars and locomotives......	34	38	17	42	29	68	2.10	2.50	.89	1.79	1.19	3.02
3. Crushers, rolls, or stamps...........	64	64	129	168	112	111	3.96	4.20	6.75	7.16	4.60	4.93
4. Tables, jigs, etc.....	65	46	59	82	61	92	4.02	3.02	3.09	3.49	2.50	4.08
5. Other machinery...	219	170	299	336	282	368	13.56	11.17	15.65	14.32	11.57	16.34
6. Falls of persons....	238	205	249	373	399	414	14.73	13.47	13.03	15.89	16.37	18.39
7. Suffocation in ore bins..............	......	2	3	4	6	11	......	.13	.16	.17	.25	.49
8. Falling objects (rocks, timbers, etc.)..............	367	222	192	363	371	389	22.72	14.58	10.05	15.47	15.22	17.28
9. Cyanide or other poisoning.........	8	9	23	13	24	45	.49	.59	1.20	.55	.98	2.00
10. Scalding (steam or water)............	24	9	12	35	18	15	1.49	.59	.63	1.49	.74	.67
11. Electricity..........	21	30	38	53	40	63	1.30	1.97	1.99	2.26	1.64	2.80
12. Hand tools, axes, bars, etc..........	199	133	235	360	249	298	12.32	8.74	12.30	15.34	10.22	13.23
13. Nails, splinters, etc.	74	78	131	171	193	165	4.58	5.12	6.85	7.29	7.92	7.33
14. Flying pieces of rock from sledging or crushing...	132	50	76	109	302	198	8.17	3.28	3.98	4.64	12.39	8.79
15. Other causes........	434	299	526	929	731	798	26.87	19.64	27.53	39.58	29.99	35.44
Total...........	1,977	1,434	2,095	3,184	2,952	3,142	122.38	94.19	109.65	135.66	121.12	139.54
Number of 300-day workers.................	16,154	15,225	19,107	23,470	24,372	22,517	......	......	......	......	......	......
Smelting plants:												
16. Haulage system (cars, motors, etc.)	386	495	529	814	693	559	15.88	15.31	14.59	16.49	13.68	12.30
17. Railway cars and locomotives......	75	111	61	117	113	87	3.09	3.43	1.68	2.37	2.23	1.91
18. Cranes..............	68	55	58	130	146	97	2.80	1.70	1.60	2.63	2.88	2.13
19. Other machinery...	253	250	290	385	375	377	10.41	7.73	8.00	7.80	7.40	8.30
20. Falls of persons.....	364	620	499	757	564	496	14.97	19.17	13.76	15.34	11.13	10.92
21. Suffocation in ore bins..............	13	1	8	1	73	5	.53	.03	.22	.02	1.44	.11
22. Flying or falling objects (rocks, timbers, etc.).....	603	1,052	914	1,438	1,107	1,050	24.81	32.53	25.21	29.13	21.85	23.11
23. Gas (burns or asphyxiation)......	18	59	68	112	48	136	.74	1.83	1.87	2.27	.95	2.99
24. Scalding (steam or water)............	45	62	46	132	76	68	1.85	1.92	1.27	2.67	1.50	1.50
25. Electricity..........	57	49	46	36	37	41	2.34	1.52	1.27	.73	.73	.90
26. Hand tools, axes, bars, etc..........	423	586	633	875	736	562	17.40	18.12	17.46	17.73	14.53	12.37
27. Nails, splinters, etc.	79	96	146	252	208	163	3.25	2.97	4.03	5.10	4.11	3.59
28. Burns from matte, slag, or molten metal (pouring or spilling)..........	777	959	894	2,163	1,488	1,290	31.96	29.66	24.65	43.82	29.37	28.39
29. Hot-metal explosions..............	148	162	160	217	242	255	6.09	5.01	4.41	4.40	4.78	5.61
30. Other causes........	938	1,116	1,366	2,227	1,839	1,557	38.59	34.51	37.67	45.11	36.30	34.27
Total............	4,247	5,673	5,718	9,656	7,745	6,743	174.71	175.44	157.69	195.61	152.88	148.40
Number of 300-day workers.................	24,309	32,336	36,262	49,363	50,659	45,439	......	......	......	......	......	......

TABLE 11.—*Summary of labor and accidents at selected* **copper** *metallurgical plants, 1916, 1917, and 1918.*

	1916		1917		1918	
	Mills.	Smelters.	Mills.	Smelters.	Mills.	Smelters.
Number of plants	17	19	20	17	44	25
Men employed	8,388	8,719	10,059	13,099	8,222	12,363
Number of 300-day workers	9,422	9,826	11,145	14,530	9,037	14,038
Total days' labor (shifts)	2,826,710	2,947,719	3,343,377	4,359,002	2,711,186	4,211,381
Average days active	337	338	332	333	330	341
Number killed	10	8	10	19	13	13
Number injured	1,493	2,187	1,232	2,154	1,521	2,227
Number killed per 1,000, 300-day workers	1.06	.81	.90	1.31	1.44	.93
Number injured per 1,000, 300-day workers	158.46	222.57	110.54	148.25	168.31	158.64

TABLE 12.—*Accidents by causes, at selected* **copper** *metallurgical plants, 1917 and 1918.*

Cause of accident.	1917				1918			
	Mills.		Smelters.		Mills.		Smelters.	
	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.
Haulage system (cars, motors, etc.)	1	57	4	166	2	41	2	147
Railway cars and locomotives	....	10	2	59	....	32	....	43
Crushers, rolls, or stamps	....	27	....	....	....	26	....	....
Tables, jigs, etc	....	18	....	....	....	44	....	....
Cranes	....	....	1	85	....	....	1	43
Other machinery	4	101	3	79	7	161	3	114
Falls of persons	....	184	2	177	1	230	1	178
Suffocation in ore bins	1	1	....	68	....	7	....	4
Falling objects (rocks, timbers, etc.)	3	194	....	272	....	208	....	402
Cyanide or other poisoning	....	10	....	....	....	31	....	....
Gas (burns or asphyxiation)	....	....	....	13	....	....	....	11
Scalding (steam or water)	....	6	1	29	....	6	....	15
Electricity	1	17	3	8	....	42	1	22
Hand tools, axes, bars, etc	....	116	....	169	....	175	....	237
Nails, splinters, etc	....	95	....	29	....	97	....	66
Flying pieces of rock from sledging or crushing	....	20	....	....	....	42	....	....
Burns from matte, slag, or molten metal	....	....	1	309	....	....	3	328
Hot-metal explosions	....	....	2	45	....	....	2	66
Other causes	....	376	....	646	3	379	....	551
Total	**10**	**1,232**	**19**	**2,154**	**13**	**1,521**	**13**	**2,227**

Table 13.—*Fatality rates in different branches of mineral industries in 1918 compared on a 300-day basis.*

[**Length of shift not considered.**]

Branch of mineral industry.	Average days active.	Men employed.		Days of labor performed.	Killed.	Number killed per 1,000 employed.	
		Actual number.	Equivalent in 300-day workers (calculated).			On actual time basis.	On 300-day basis.
Metal mines	297	182,606	181,006	54,301,748	646	3.54	3.57
Metallurgical works:							
Ore-dressing plants	310	21,809	22,517	6,754,962	35	1.60	1.55
Smelters[a]	342	39,899	45,439	13,631,601	42	1.05	.92
Auxiliary works	334	18,044	20,111	6,033,184	17	.94	.85
Coal mines	258	762,426	654,973	196,491,984	2,579	3.38	3.94
Coke ovens:							
Beehive	300	16,442	16,436	4,930,694	19	1.16	1.16
By-product	358	15,947	19,040	5,711,994	54	3.39	2.84
Quarries (inside)	252	44,082	37,042	11,112,556	81	1.84	2.19
Quarries (outside)	275	24,250	22,243	6,672,948	44	1.81	1.98
Total, 1918	272	1,125,505	1,018,642	305,641,671	3,517	3.13	3.45
Total, 1917	266	1,156,645	1,025,916	307,774,565	3,871	3.35	3.77

[a] Does not include iron and steel industry.

PUBLICATIONS ON ACCIDENT STATISTICS.

A limited supply of the following publications of the Bureau of Mines has been printed and is available for free distribution until the edition is exhausted. Requests for all publications can not be granted, and to insure equitable distribution applicants are requested to limit their selection to publications that may be of especial interest to them. Requests for publications should be addressed to the Director, Bureau of Mines.

The Bureau of Mines issues a list showing all its publications available for free distribution as well as those obtainable only from the Superintendent of Documents, Government Printing Office, on payment of the price of printing. Interested persons should apply to the Director, Bureau of Mines, for a copy of the latest list.

PUBLICATIONS AVAILABLE FOR FREE DISTRIBUTION.

Bulletin 115. Coal-mine fatalities in the United States, 1870–1914, with statistics of coal production, labor, and mining methods, by States and calendar years, compiled by A. H. Fay. 1916. 570 pp., 3 pls., 13 figs.

Bulletin 140. Occupational hazards at blast-furnace plants and accident prevention, based on records of accidents at blast furnaces in Pennsylvania in 1915, by F. H. Willcox. 1917. 155 pp., 16 pls.

Technical Paper 46. Quarry accidents in the United States during the calendar year 1911, compiled by A. H. Fay. 1913. 32 pp.

Technical Paper 61. Metal-mine accidents in the United States during the calendar year 1912, compiled by A. H. Fay. 1913. 76 pp., 1 fig.

Technical Paper 92. Quarry accidents in the United States during the calendar year 1913, compiled by A. H. Fay. 1914. 76 pp.

Technical Paper 118. Coke-oven accidents in the United States during the calendar years 1913 and 1914, compiled by A. H. Fay. 1915. 16 pp.

Technical Paper 124. Accidents at metallurgical works in the United States during the calendar years 1913 and 1914, compiled by A. H. Fay. 1915. 28 pp.

Technical Paper 128. Quarry accidents in the United States during the calendar year 1914, compiled by A. H. Fay. 1915. 45 pp.

Technical Paper 129. Metal-mine accidents in the United States during the calendar year 1914, compiled by A. H. Fay. 1915. 96 pp., 1 pl., 3 figs.

Technical Paper 151. Coke-oven accidents in the United States during the calendar year 1915, compiled by A. H. Fay. 1916. 18 pp.

Technical Paper 164. Accidents at metallurgical works in the United States during the calendar year 1915, compiled by A. H. Fay. 1916. 20 pp.

Technical Paper 165. Quarry accidents in the United States during the calendar year 1915, compiled by A. H. Fay. 1917. 77 pp., 1 pl.

Technical Paper 168. Metal-mine accidents in the United States during the calendar year 1915, compiled by A. H. Fay. 1917. 114 pp., 2 figs.

Technical Paper 193. Quarry accidents in the United States during the calendar year 1916, compiled by A. H. Fay. 1917. 21 pp.

Technical Paper 201. Accidents at metallurgical works in the United States during the calendar year 1916, compiled by A. H. Fay. 1918. 18 pp.

Technical Paper 202. Metal-mine accidents in the United States during the calendar year 1916, compiled by A. H. Fay. 1918. 91 pp.

Technical Paper 206. Coke-oven accidents in the United States during the calendar year 1917, compiled by A. H. Fay. 1918. 19 pp.

Technical Paper 213. Quarry accidents in the United States during the calendar year 1917, compiled by A. H. Fay. 1918. 62 pp.

Technical Paper 215. Accidents at metallurgical works in the United States during the calendar year 1917, compiled by A. H. Fay. 1919. 23 pp.

Technical Paper 239. Coke-oven accidents in the United States during the calendar year 1918, by A. H. Fay. 1919. 26 pp.

Technical Paper 245. Quarry accidents in the United States during the calendar year 1918, compiled by A. H. Fay. 1920. — pp.

Technical Paper 252. Metal-mine accidents in the United States, 1918, compiled by A. H. Fay. 1919. — pp.

Coal-mine fatalities in the United States, 1916, compiled by A. H. Fay. 1917. 42 pp.

Coal-mine fatalities in the United States, 1917, compiled by A. H. Fay. 1918. 37 pp.

Coal-mine fatalities in the United States, 1918, compiled by A. H. Fay. 1919. 61 pp.

PUBLICATIONS THAT MAY BE OBTAINED ONLY THROUGH THE SUPERINTENDENT OF DOCUMENTS.

Bulletin 69. Coal-mine accidents in the United States and foreign countries, compiled by F. W. Horton. 1913. 102 pp., 3 pls., 40 figs. 25 cents.

Technical Paper 27. Monthly statement of coal-mine accidents in the United-States, January to August, 1912, and statistics for 1910 and 1911, compiled by F. W. Horton. 1912. 24 pp. 5 cents.

Technical Paper 40. Metal-mine accidents in the United States during the calendar year 1911, compiled by A. H. Fay. 1913. 54 pp. 5 cents.

Technical Paper 48. Coal,mine accidents in the United States, 1896–1912, with monthly statistics for 1912, by F. W. Horton. 1913. 74 pp., 10 figs. 10 cents.

TECHNICAL PAPER 73. Quarry accidents in the United States during the calendar year 1912, compiled by A. H. Fay. 1914. 45 pp. 5 cents.

TECHNICAL PAPER 94. Metal-mine accidents in the United States during the calendar year 1913, compiled by A. H. Fay. 1914. 73 pp. 10 cents.

TECHNICAL PAPER 173. Coke-oven accidents in the United States during the calendar year 1916, compiled by A. H. Fay. 1917. 22 pp. 5 cents.

Coal-mine fatalities in the United States during the calendar year 1915, with detailed figures for December, compiled by A. H. Fay. 1916. 80 pp., 3 figs. 10 cents.

Coal-mine fatalities in the United States during the calendar year 1916, compiled by A. H. Fay. 1917. 80 pp., 8 figs. 10 cents.

○